Environmental Risk of Army Ranges and Impact Areas: A Framework for Assessment

Major Steve Houston

Dr. William W. Doe III

Dr. Robert B. Shaw

CENTER for ENVIRONMENTAL MANAGEMENT of MILITARY LANDS

29 August 2001

Background

- **Balancing Readiness and Sustainable Range Management**
- **Sustainable Range Management in the face of Regulatory Tre**

Reductions in Force and Installation Structure

Dramatic Increase in Operational Tempo

More Sophisticated Weapons Systems

Exceeding Range and Impact Area Carrying Capacity

Unexploded Ordnance (UXO) and Constituents

UXO as a Hazardous Waste (RCRA,CERCLA)

Massachusetts Military Reservation

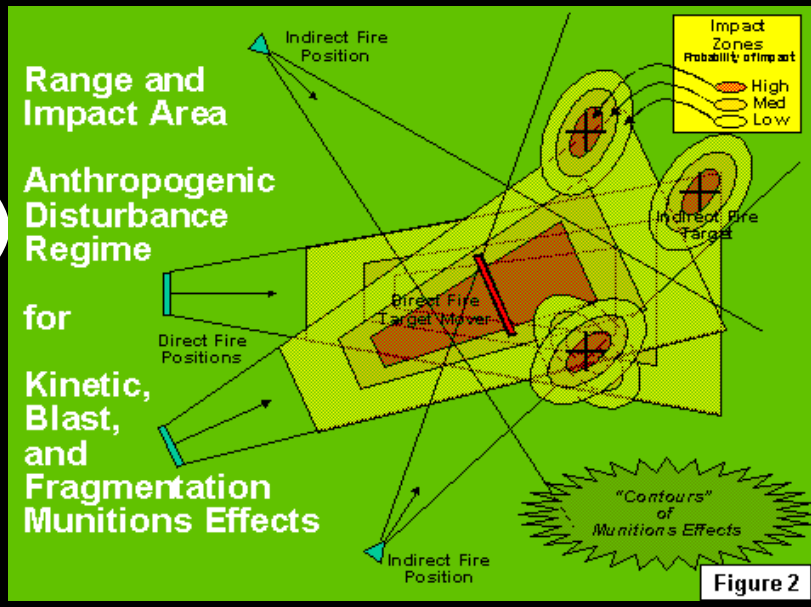
READINESS vs ENVIRONMENTAL STEWARDSHIP

Contaminant Threat Analysis

Trinitrotolulene (TNT)
Royal Demolition Explosive (RDX)
High Melting Explosive (HMX)

Toxic Substances

Spatial Distribution



Fate and Transport Characteristics

- **Mobilization by dissolution with wat**
- **Immobilization by adsorption to soil**
- **Transformation by biological acti**

Impact Area Resilience

Biotic and abiotic processes that enhance an ecosystem's ability to attenuate UXO contamination.

Biotic Processes

Microbial Action

Phyto-sequestration

Abiotic Processes

Dissolution

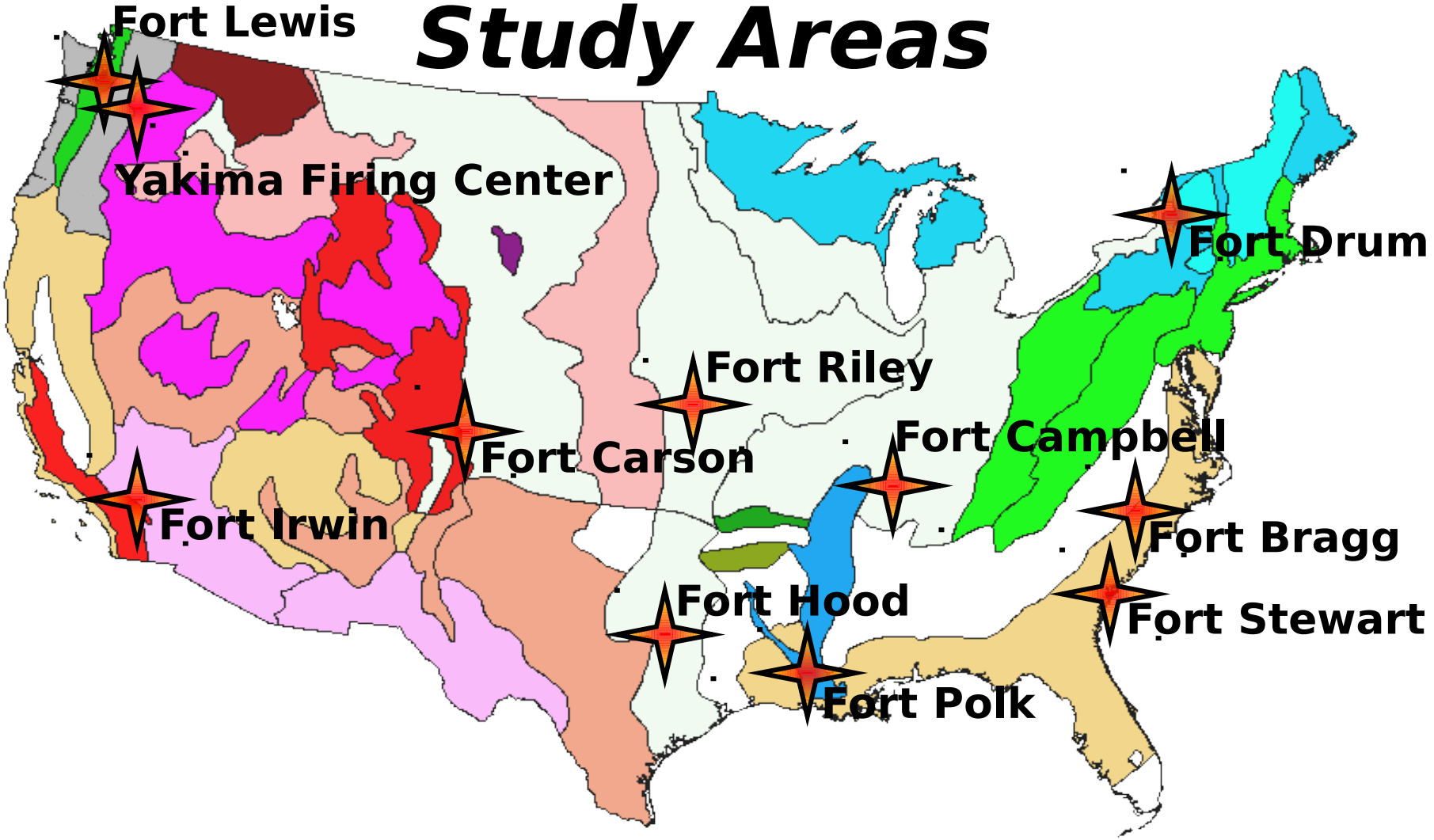
Adsorption

Attenuation Potential

Small ← Gradient → Large

High Moisture Surplus	**Dissolution** Mobilization	High Moisture Deficit
Low Cation Exchange Capacity	**Adsorption** Immobilization	High Cation Exchange Capacity
Low Organic Carbon Content Short Effective Growing Season	**Bio-Action** Transformation	High Organic Carbon Content Long Effective Growing Season

Study Areas



Eleven Forces Command (FORSCOM) Installations

Bailey's Ecoregions of the United States -

Soil Taxa, Vegetation, Surface Water Characteristics, etc.

Resiliency Assessment Framework

Impact Area Resilience

- Key Environmental Processes
- Ecosystem Components
- Ecological Settings
- Resiliency Metrics

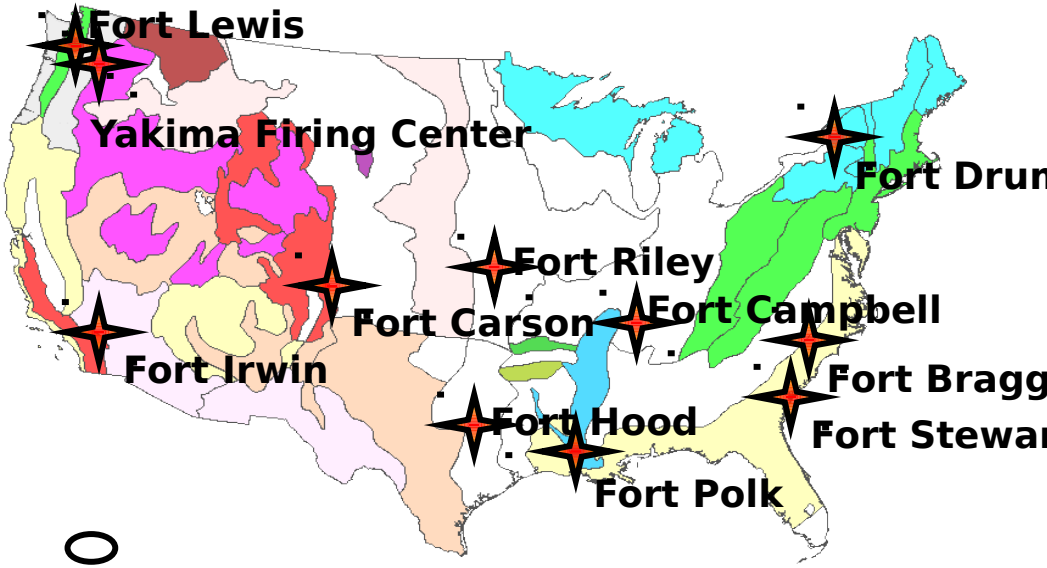
Biotic and Abiotic Processes that Enhance an Ecosystem's Ability to Attenuate UXO Contamination.

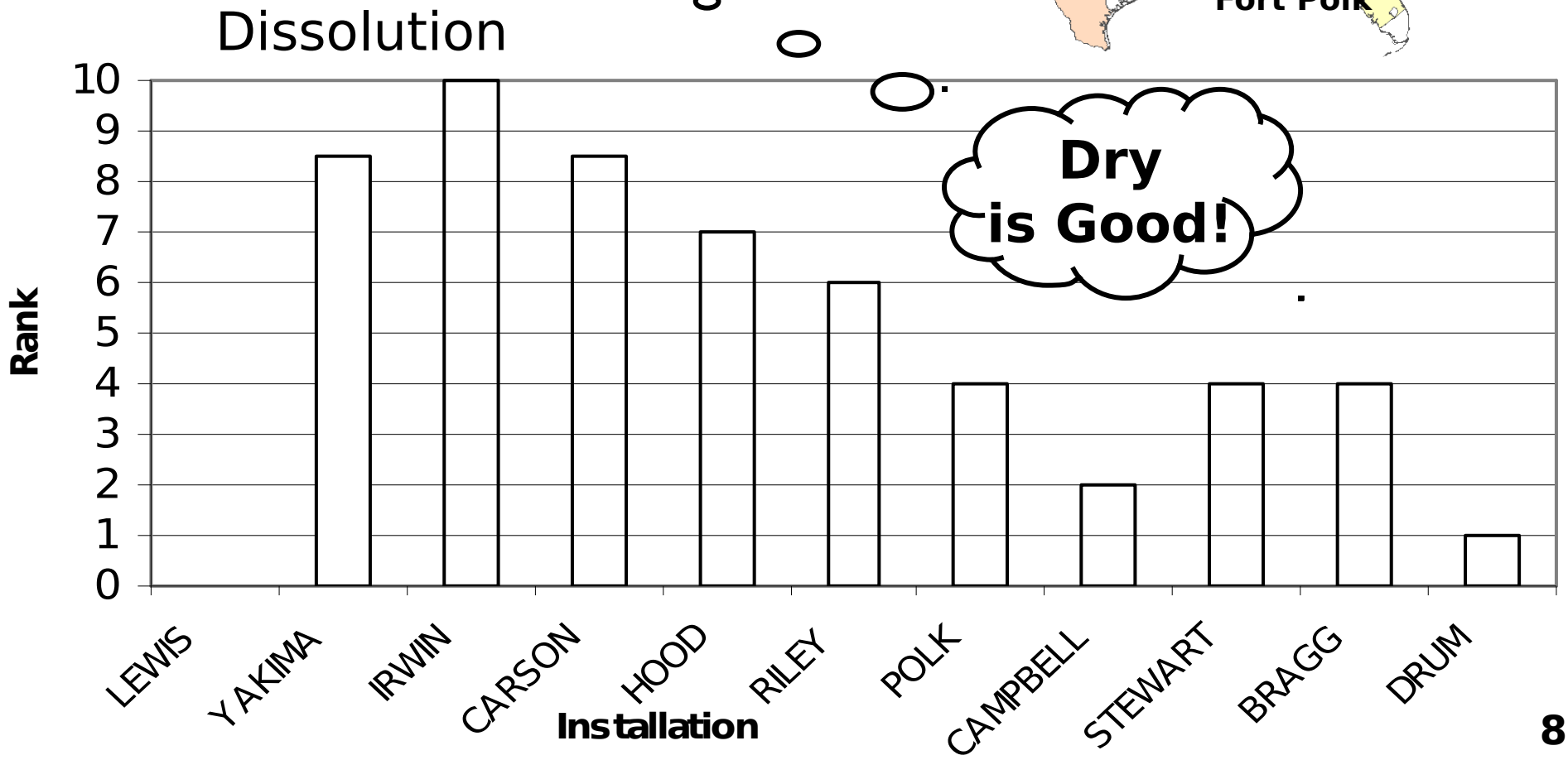
Dissolution - Mobilization Effect
Adsorption - Immobilization Effect
Biological Action - Transformation Effect
Hydrologic, Geomorphic and Biological Processes

Moisture Conditions
Soil Conditions
Growing Conditions

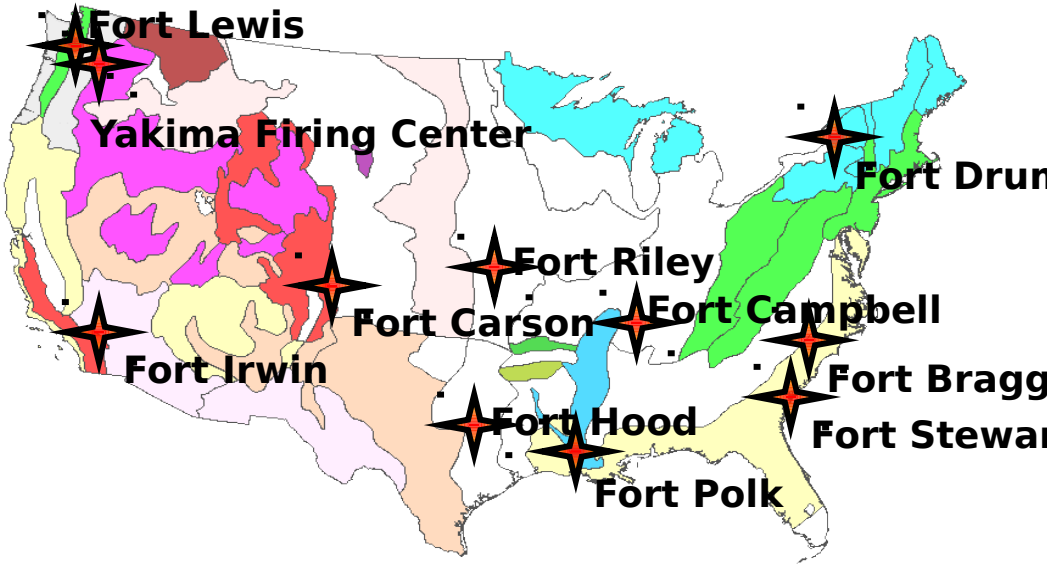
Thornthwaite Moisture Regions
Average CEC for each Soil Order
Average SOC for each Soil Order
Effective Growing Season

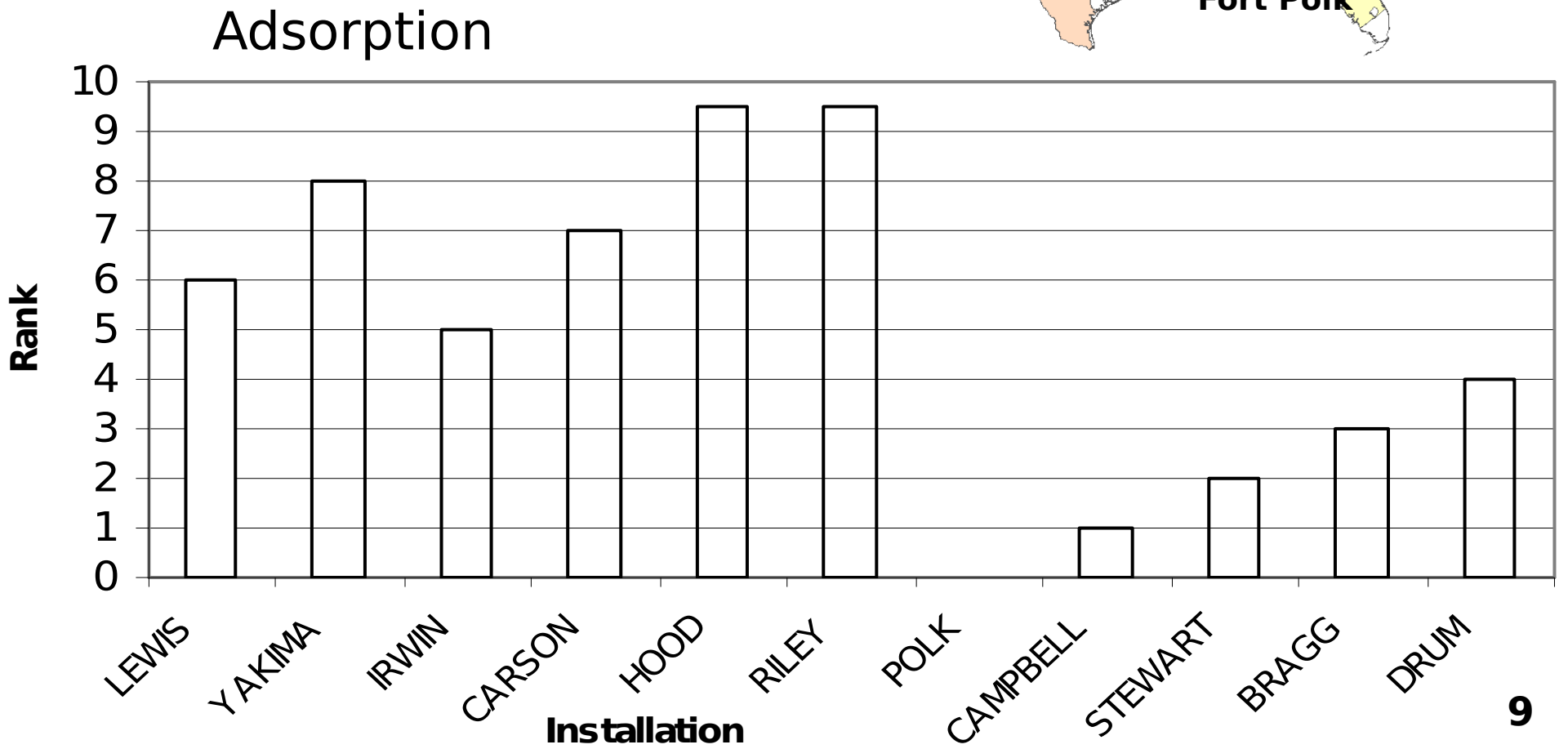
Impact Area Mobilization Potential



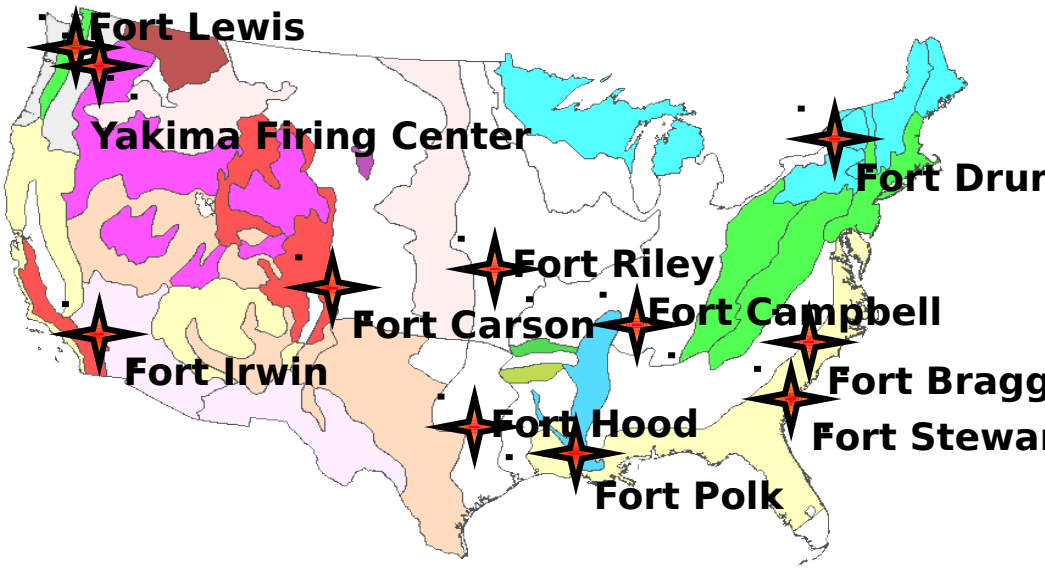


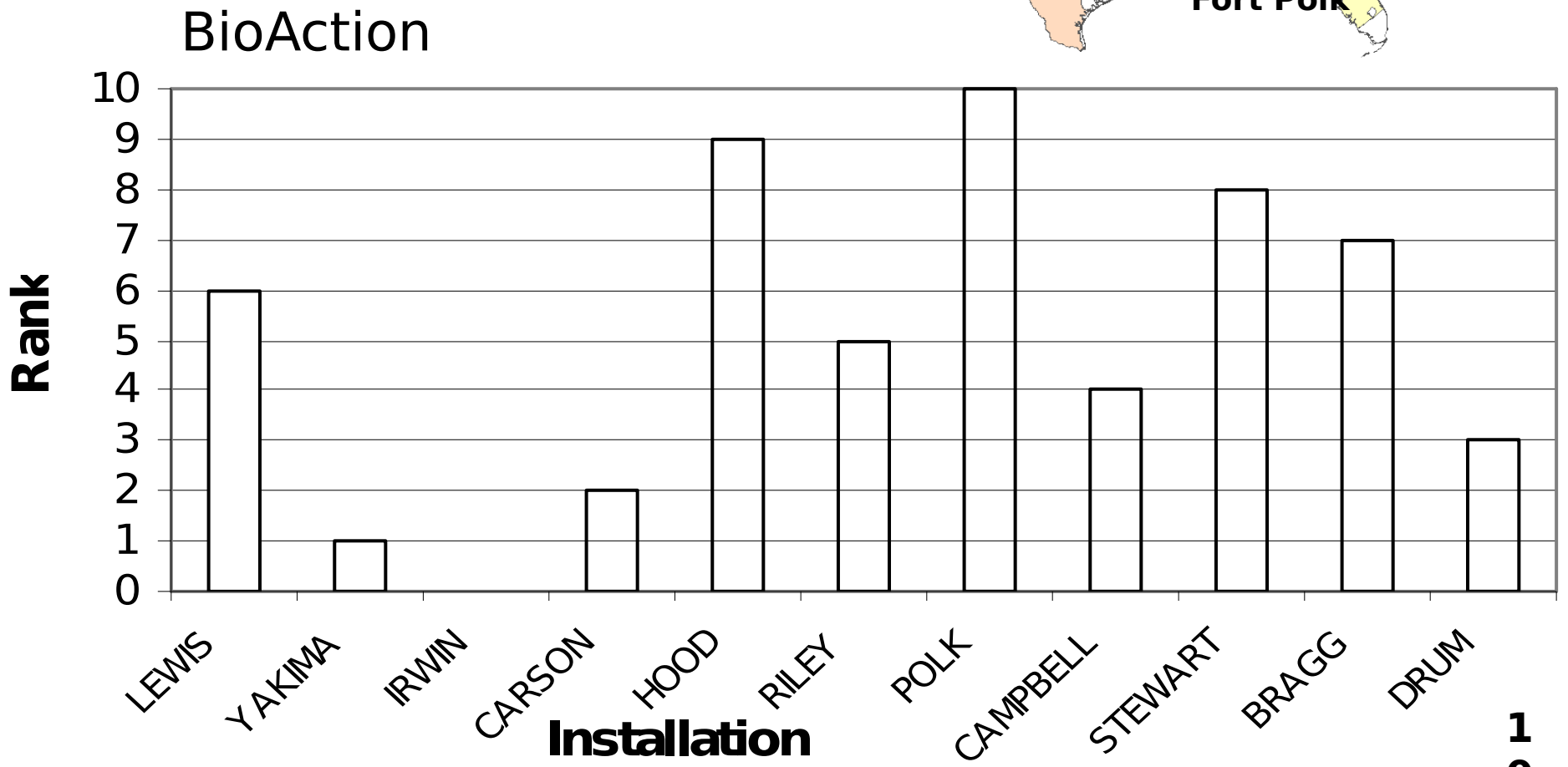
Impact Area Immobilization Potential





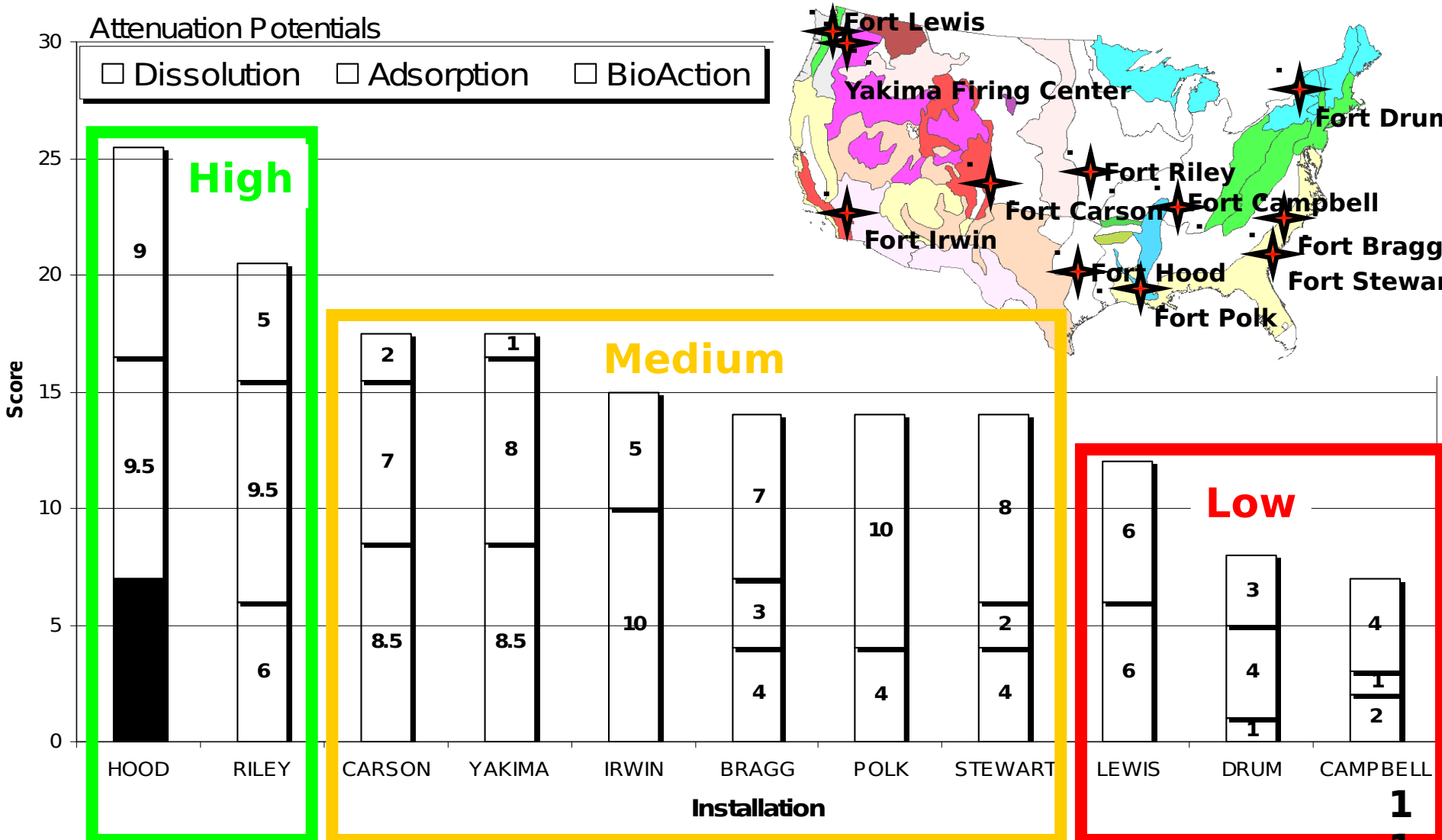
Impact Area Transformation Potential



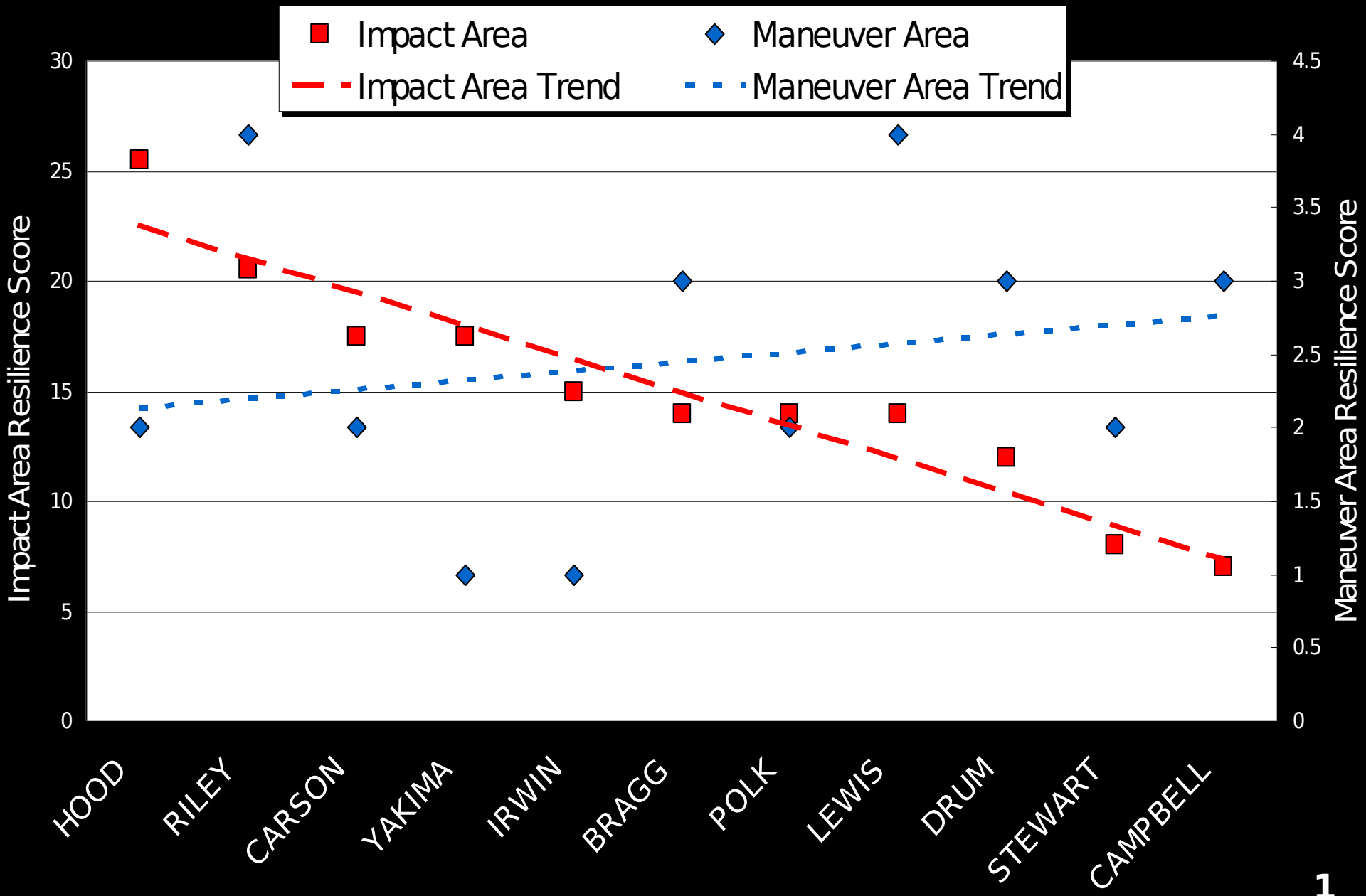


Resilience Rankings

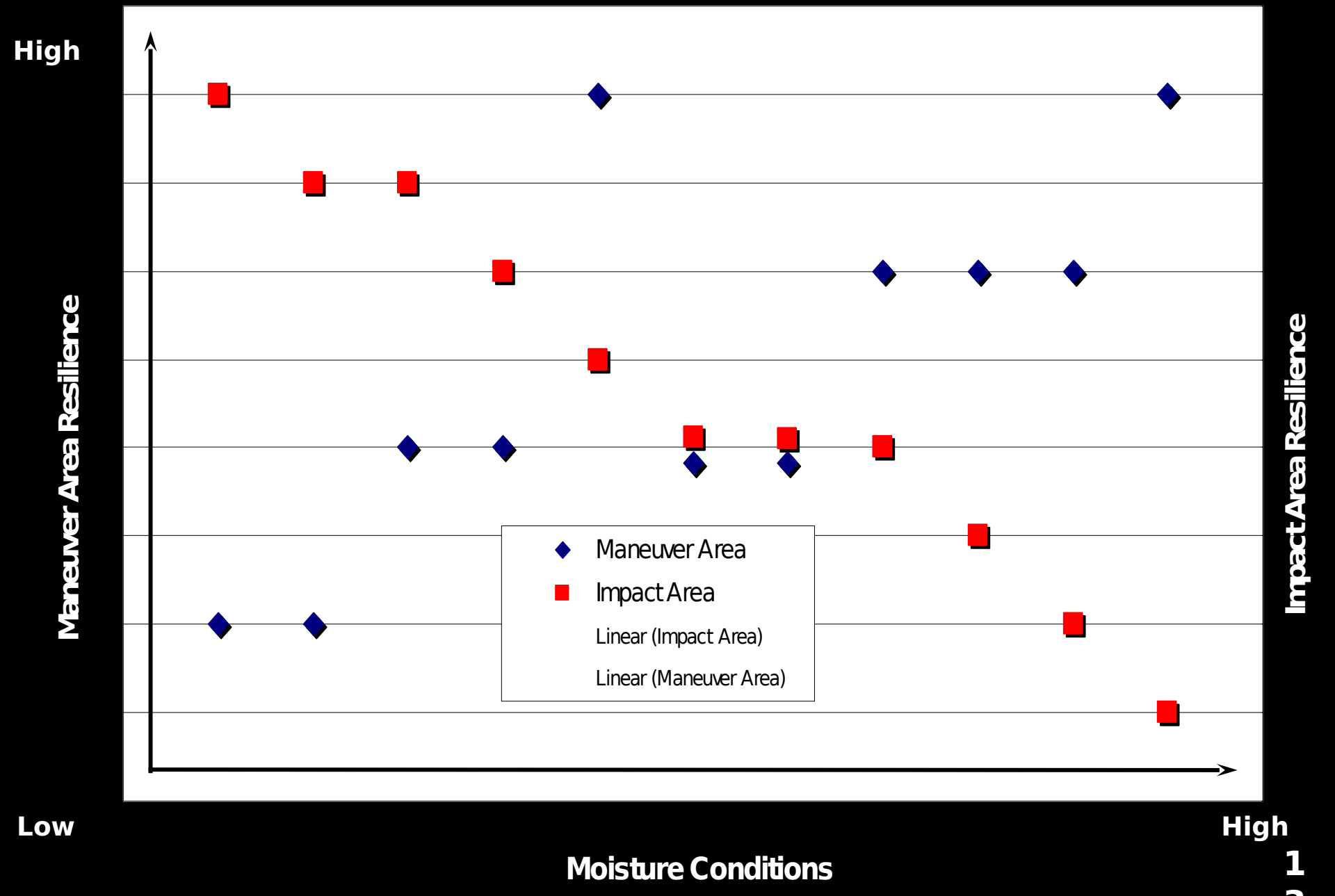
Relative UXO Resilience of Army Impact Areas



Impact Area vs Maneuver Area Resilience



Maneuver vs Impact Area Resilience



Strategic Insight

- **Management**
  - **High available moisture setting - focus might be isolating contaminant from groundwater sources.**
  - **Soil management and conservation practices that reduce erosion and build soil organic matter content.**
- **Acquisition**
  - **Improve the reliability and performance of munitions.**
  - **Continued development of “Green Ammo.”**
  - **Munitions tagging for tracking UXO.**
- **Digital Integration**
  - **Leverage digital tracking of munitions and UXO.**
  - **Integrate synthetic targeting and land management.**

Questions